SiC News

Poly SiC patent

SiC wafer manufacturer Sullivan & Company Inc (Indianapolis, IN, USA) has been awarded a US Patent (No. 6,077,619), claiming application of its DATANITE defect-free polycrystalline SiC wafers to transistors.

According to Professor James A Cooper of the School of Electrical and Computer Engineering at Purdue University (Lafayette, IN, USA), "Megawatt and gigawatt transistors require at least 2 cm^2 or more of contiguous defect-free SiC wafer. Polycrystalline SiC wafers do not have micropipe defects, but lesser defects arising from local grain boundaries in the material may limit operating voltage of transistors. Sullivan's DATANITE 8″ diameter wafers have 314 cm^2 of usable surface area without a single micropipe, opening the possibility of moderate-voltage, very high-current devices with power ratings considerably above those available with monocrystalline SiC wafers."

Previously Purdue University has used SiC to form a novel accumulation-channel MOSFET (ACCUFET) having an off-mode blocking voltage (V_B) of 1400 V and an on-mode resistance (R_{ON}) of 15.7 mV/cm^2. For this SiC device, the figure-of-merit, V_B^2/R_{ON} is 125 MW/cm^2, 25x higher than the theoretical limit for silicon power MOSFETs.

Inefficiencies in switching and power conversion can cost 5% power loss. Electrical power is switched and converted using mechanical switches, transformers, and silicon rectifier diodes. Megawatt and gigawatt macrochip transistors can reduce peak electric generating requirements. However, monocrystalline SiC power transistors have been frustrated by fatal defects in wafers.

Monocrystalline alpha-phase 4H- and 6H-SiC wafers have demonstrated high voltages and current densities eight times greater than silicon, but have up to 50 micropipes per cm^2, enabling avalanche breakdown of the transistor. Devices must fit between micropipes to avoid leaks, limiting the size of transistors for monocrystalline SiC. Sullivan claims that its DATANITE polycrystalline beta-phase 3C-SiC wafers has no micropipes (due to epi deposition by a unique version of CVD), so devices can be as large as the wafer.

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GaN News

28% efficient InGaN LED

Cree Lighting Company (formerly Nitres) has demonstrated an LED with the highest known external quantum efficiency reported for a UV-to-blue LED (28%).

The InGaN LED emits 17 mW at 400 nm (violet/near-UV - important for phosphor down-conversion of the wavelength to make a white bulb). Overall "wall plug" efficiency is 22%.

• Cree Inc (Durham, NC, USA) has received contracts from several Asian and European customers totalling US$70m for shipments through September 2001 (including its largest ever: a one-year purchase agreement with Osram Opto Semiconductors GmbH for SiC LEDs and wafer products) and further contracts from Asia totalling US$21m for shipment during financial 2001 included SiC LEDs.

Substrate Briefs

Q2/2000 sales for **AXT Inc** (Fremont, CA, USA) were a record US$28.9m (up 21% on Q1 and 39% on Q2/99).

• Don Tatzin has joined AXT as chief financial officer (after serving as a member of the board of directors since February 1998 and interim CFO since May).

The company has also formally changed its name to AXT Inc.

SiC Briefs

The **Rockwell Science Center** (Thousand Oaks, CA, USA) has received a US$1m contract from the US Air Force Research Laboratory to develop high-efficiency, radiation-hardened power electronics for use in space (including a modular, high-density SiC power switch for power conditioning and distribution systems in platforms such as the Space Based Laser, Orbital Transfer Vehicle and Spaced Based Radar).

Benefits include ten-fold reductions in power loss as well as increases in switching speed and power density, enabling a five-fold reduction in the weight and size of the power system.

Commercial applications include medical electronics, automotive electronics, electrical utilities, and aircraft ignition systems.

The Compound Semiconductor and Optoelectronics segment of **Uniroyal Technology Corporation** (Sarasota, FL, USA) recorded Q3/2000 sales of US$304,000 (up from US$253,000 in Q3/99). A loss of US$4.961m is mainly due to costs of ramping-up the HB-LED plant in Tampa, FL, USA and goodwill amortization from the purchase of Sterling Semiconductor.